PATENT ABSTRACTS OF JAPAN

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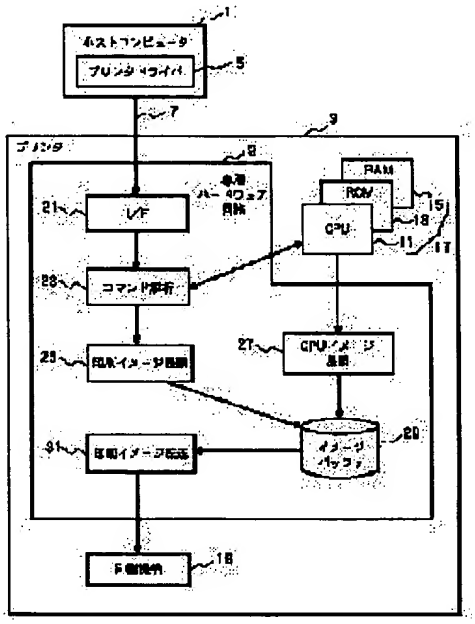
(54) PRINTER AND PRINT SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To realize high-speed printing by an inexpensive printer.
SOLUTION: A printer 3 has a special hardware circuit 9. The special hardware circuit 9 receives a printing command from a host 1, processes image data thereby developing print images when the received command is a command sending the image data and, sends the image data to a printing mechanism 19 such as a printing head or the like. The special hardware circuit 9 sends the received command to a CPU 11 to process the command at the CPU 11 when the command is a command related to printing conditions or feeding of a paper, etc. The CPU 11 does not process the image data in principle.



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CLAIMS

[Claim(s)]
[Claim 1] The printer equipped with the exclusive hardware circuitry which generates the printing image which should process the image data included in said printing command in the printer which receives a series of printing commands and drives a print station based on said printing command, and should be sent to said print station.
[Claim 2] It is the printer according to claim 1 which processes other printing commands furthermore have a microcomputer, said exclusive hardware circuitry processes only some [containing the printing command which sends said image data among the printing commands of the varieties contained in said a series of printing commands / predetermined] printing commands, and excluding [said microcomputer] some [said / predetermined] printing commands at least among the printing commands of said varieties.
[Claim 3] It is the printer according to claim 2 analyze the printing command which said exclusive hardware circuitry received by the interface circuitry which receives said printing commands of a series of, the printing image expansion circuit which processes the printing command with which said image data is sent, and generates said printing image, and said interface circuitry, and the printing command send said image data transmits to said printing image expansion circuit, and have the command analysis circuit a printing command besides the above transmits to said microcomputer.
[Claim 4] The printer according to claim 2 which has the printing image transfer circuit which transmits said printing image which said exclusive hardware circuitry is the memory for developing said printing image, and was developed by original memory other than the memory of said microcomputer, and said original memory to said print station.
[Claim 5] The printer according to claim 4 which has a CPU image expansion circuit for that for said exclusive hardware circuitry to develop to said original memory in response to the printing image which said microcomputer generated further.
[Claim 6] Said exclusive hardware circuitry receives said a series of printing commands. In the normal mode When the received printing commands are some [said / predetermined] printing commands, When it is what understands and processes said received printing command and cannot understand said received printing command, It transmits to said microcomputer, without shifting to giving-up mode henceforth and understanding all of said received command and a consecutive command. Said microcomputer When said received command is a restart command predetermined [understanding and processing the command received from said exclusive hardware circuitry and], The printer according to claim 2 which gives a restart signal to said exclusive hardware circuitry, and is returned to said normal mode from said giving-up mode.
[Claim 7] Said exclusive hardware circuitry which the meaningless data of the amount which can cover the time amount taken for said exclusive hardware circuitry to return to said normal mode from said giving-up mode are added to said restart command, and is in said microcomputer and said normal mode is a printer according to claim 6 which reads and throws away said meaningless data.
[Claim 8] The printer according to claim 2 by which said microcomputer may be contained in said a series of printing commands and which can process all printing commands substantially.
[Claim 9] The print system equipped with the exclusive hardware circuitry which generates the printing image which said printer should process the image data included in said printing command

in the print system equipped with the host computer with a printer driver, and the printer which receives a series of printing commands which said printer driver generated, and drives a print station based on said printing command, and should be sent to said print station.
[Claim 10] It is the print system according to claim 9 which processes other printing commands said printer is further equipped with a microcomputer, said exclusive hardware circuitry processes only some [containing the printing command which sends said image data among the printing commands of the varieties contained in said a series of printing commands / predetermined] printing commands, and excluding [said microcomputer] some [said / predetermined] printing commands at least among the printing commands of said varieties.
[Claim 11] the time of said printer driver sending said a series of printing commands — said — others — a predetermined restart command in case it changes from a printing command to some [said / predetermined] printing commands — delivery — The exclusive hardware circuitry of said printer receives said a series of printing commands. In the normal mode When the received printing commands are some [said / predetermined] printing commands, When it is what understands and processes said received printing command and cannot understand said received printing command, It transmits to said microcomputer, without shifting to giving-up mode henceforth and understanding all of said received command and a consecutive command. Said microcomputer When the command received from said exclusive hardware circuitry is understood and processed and said received command is said restart command, The print system of the ****** 10 publication which gives a restart signal to said exclusive hardware circuitry, and is returned to said normal mode from said giving-up mode.
[Claim 12] Said exclusive hardware circuitry which said printer driver adds the meaningless data of the amount which can cover the time amount which said exclusive hardware circuitry takes to return to said normal mode from said giving-up mode to said restart command, and is in said microcomputer and said normal mode is a print system according to claim 11 which reads and throws away said meaningless data.
[Claim 13] The exclusive hardware circuitry which processes only some [predetermined] printing commands among the printing commands of the varieties which receive a series of printing commands and are contained in said a series of printing commands, As opposed to the printer equipped with the microcomputer which processes other printing commands except some [said / predetermined] printing commands among the printing commands of the varieties contained in said a series of printing commands When it is the host computer which sends said a series of printing commands and said a series of printing commands are sent, The host computer which sends the reset command for ordering said microcomputer to restart said exclusive hardware circuitry to said microcomputer in case it changes from a printing command besides the above to some [said / predetermined] printing commands.
[Claim 14] The host computer according to claim 13 which carries out specified quantity addition of the meaningless data which said exclusive hardware circuitry and said microcomputer read and throw away into said restart command.
[Claim 15] The exclusive hardware circuitry which processes only some [predetermined] printing commands among the printing commands of the varieties which receive a series of printing commands and are contained in said a series of printing commands, As opposed to the printer equipped with the microcomputer which processes other printing commands except some [said / predetermined] printing commands among the printing commands of the varieties contained in said a series of printing commands When it is the host computer which sends said a series of printing commands and said a series of printing commands are sent, When changing from a printing command besides the above to some [said / predetermined] printing commands, As a host computer which sends the reset command for ordering said microcomputer to restart said exclusive hardware circuitry to said microcomputer The record medium which supported the printer driver program for operating a computer and in which computer reading is possible.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the printer suitable for high-speed printing.
[0002]
[Description of the Prior Art] The printer generally used by the computer system interprets to reception a series of printing commands described with the predetermined printer control language from the host computer, interprets those printing commands in order, and performs printing actuation based on the interpretation result. The conventional printer contains the microcomputer which consists of CPU, a ROM, RAM, etc., and chiefly, a printing command is received from a host, this is interpreted, and this microcomputer is based on that interpretation result, and is driving and controlling devices, such as the print head.
[0003]
[Problem(s) to be Solved by the Invention] Inevitably, the processing speed of the microcomputer in a printer is an important factor which influences the print speed of a printer. Therefore, although the conventional high speed printer carries CPU of a high speed and high performance, the price is as high as cone **** as a result.
[0004] Therefore, the object of this invention is a low price, and is to offer the printer in which high-speed printing is possible.
[0005]
[Means for Solving the Problem] This invention offers the technique which freed itself from the conventional method of performing all command processing by CPU, radically. Generally, various printing commands, such as a command which specifies the various parameters about printing conditions etc., and a command which sends the image data which is an object for printing, are contained in a series of printing commands which a printer receives. Since the greater part of this printing command of a series of is occupied by the image data, the great portion of processing which a printer performs is processing of an image data. Typically, processing of this image data thaws the image data which is usually compressed in the form of predetermined, and is included in the printing command from the ejection from a command, and compression, and changes it into the specific format of having been suitable for actuation of print stations, such as the print head, (the so-called "expansion of a printing image"), and data manipulation of transmitting that printing image to a print station is performed according to the timing of a print station of operation. Although this image-data processing is made to perform to CPU chiefly with the conventional technique, this is only the huge repeat of the rather simple data manipulation instead of processing exceptionally complicated for CPU. However, CPU is equipment which originally fitted complicated processing and general-purpose usage, and cannot demonstrate rapidity sufficient in an activity which repeats simple data manipulation and performs it. In such an activity, many of work of CPU is beginning to put data into memory and making them it, and since data receipts and payments of the count of huge are serially repeated on the target through one CPU bus, so high-speed processing can be desired neither from the rate of a CPU bus, nor constraint of occupancy time amount. On the other hand, although there are few throughputs of each command about a command which notifies various kinds of parameters about printing conditions etc. also in a printing command, since the contents of processing differ for every command and various

commands exist, it is suitable for processing by CPU.
[0006] Based on such reflection, by this invention, the exclusive hardware circuitry which performs image-data processing is carried in a printer, and CPU is released from the repeat activity of simple data manipulation. Since image-data processing is performed by exclusive hardware circuitry, naturally as compared with the conventional technique in which it was performed by CPU, high-speed printing becomes possible. However, there is also an advantage that the advantage of this invention not only of it but a price hike according to this amelioration further is small. That is, since the content of processing of image-data processing is simple in comparison, the exclusive hardware circuitry does not need to be so complicated structure, and, therefore, it can be managed with a low price. Moreover, since Printer CPU was released from image-data processing, it does not need to be so high-speed and is easy to be the thing of a low price. Therefore, the high-speed printing engine performance can be attained, without raising a price like the conventional technique which introduces a high speed CPU.
[0007] Although exclusive hardware circuitry is not unable to be made to perform all command processing, with a suitable operation gestalt, exclusive hardware circuitry only understands and processes the printing command which sends an image data, and the printing command of other fractions, and CPU processes other various printing commands. If it does so, hardware circuitry does not become complicated too much in vain, moreover, self can perform command processing of a favorite class and CPU can attain most effectively the object of the improvement in the speed mentioned above and low-pricing.
[0008] Moreover, with a suitable operation gestalt, exclusive hardware circuitry communicates with a host computer, data are received, it judges whether it is the predetermined command with which the data can process self, and the data which cannot be processed are sent to CPU. Therefore, CPU stops involving also about a communication interface with a host computer, and it leads to much more improvement in the speed.
[0009] Moreover, with a suitable operation gestalt, exclusive hardware circuitry has original memory different from RAM of CPU, and sends a printing image to a print station, without developing a printing image in this memory and minding CPU. This configuration is also one device which releases CPU from image processing. Moreover, although CPU may generate a printing image exceptionally so that it may mention later, exclusive hardware circuitry receives the printing image which CPU generated also in such a case, and it develops in self memory, and sends to a print station. This also mitigates the burden of CPU and leads to much more improvement in the speed.
[0010] For every page, the command group which specifies printing conditions etc. comes previously, and the command which sends an image data usually follows sequence in case a printing command comes from a host at it. Although this sequence is adopted also with the suitable operation gestalt of this invention, delivery (such a condition of exclusive hardware circuitry is called "giving-up mode") and CPU understand these commands to CPU, and he is trying for exclusive hardware circuitry to process to it the command group which specifies the printing conditions which come previously, without understanding this. And the command group which specifies printing conditions etc. finishes, and when it is going to begin to send the command which sends an image data next, he is trying for the printer driver by the side of a host to send the meaningless data (NULL data) of a considerable amount (for example, dozens of bytes) for the special command ("restart command") which orders CPU to wake exclusive hardware circuitry from giving-up mode after delivery and this restart command in advance of it. Meaningless data are only sent until it wakes up thoroughly by this command configuration, although exclusive hardware circuitry wakes up from giving-up mode with a restart command just before receiving the command of an image data, and after waking up thoroughly, the command of an image data will be received for the first time. As a result, exclusive hardware circuitry can start image-data processing certainly.
[0011] Furthermore, with the suitable operation gestalt, the firmware of CPU understands all the commands that may come from a host, and it is perfectly prepared so that all processings also including image-data processing can be performed by CPU. Thereby, the printer driver for example, by the side of a host is an old version, and even if it has sent the image by the printing command of the old version which cannot understand exclusive hardware circuitry, a printer can

understand those printing commands by CPU, can develop a printing image, and can be printed normally. Moreover, it is possible for the printer to be connected with the network, and for a printer to process the image for a carrier beam case etc. by CPU from the Network OS of the Network Server instead of a printer driver, and to, print an image data (for example, image of a banner) for example.

[0012]

[Embodiment of the Invention] Drawing 1 shows the configuration of 1 operation gestalt of this invention.

[0013] The printer 3 is connected to the host computer 1 through the local interface or the network. The printer driver 5 for printer 3 is carried in the host computer 1, and this printer driver 5 generates a series of printing commands described with the predetermined printer control language which can understand a printer 3, and sends that printing command of a series of to a printer 3 through OS. If the breakdown of this printing command of a series of is said simply, the printing command group which the printing command group which specifies printing conditions etc. for every page is sent previously, and sends an image data will follow it.

[0014] in addition , the image data include in the printing command presuppose that it be compress by the fixed technique of be a data gestalt (CMYK raster image data which be the 2 gradation as the expression capacity of a printer 3 with the same number of gradation or the several floor tone of each color component value of each pixel typically) in which rasterize , color conversion , half toning , interlace processing , etc. be already finished by the printer driver 5 side with this operation gestalt . However, as long as that is not necessarily right, it may not necessarily be and you may be other image-data gestalten (for example, for example, color conversion, half toning, full color RGB raster data before interlace processing, etc.). Although complicated extent of the image-data processing which should be performed by the printer 3 side by what kind of gestalt the image data in a printing command is differs, since there is no need of performing color conversion, half toning, and interlace processing in a printer 3 side in the case of this operation gestalt, the image-data processing will become the easiest.

[0015] The exclusive hardware circuitry 9 for performing image-data processing is carried in the printer 3. This exclusive hardware circuitry is ASIC (ApplicationSpecific IC), and is the last computer which would perform software by CPU. On the other hand, the microcomputer 17 which consists of CPU11, ROM13, RAM15, etc. is also carried, and exclusive hardware circuitry 9 is connected to the bus of CPU11. This microcomputer 17 is programmed to be able to process the printing command of all the classes that a printer 3 may receive as firmware in ROM13, although it is for mainly performing processings (for example, printing command processing about printing conditions etc.) which exclusive hardware circuitry 9 does not perform in processing with the need that a printer 3 performs. Moreover, the print stations 19, such as the print head for printing a printing image on a form actually using a coloring agent, are also connected to exclusive hardware circuitry 9.

[0016] Exclusive hardware circuitry 9 performs communication-interface processing with a host computer, and has the host interface circuit 21 which receives the data from a printer driver 5, and the command analysis circuit 13 which analyzes the received data and changes the destination. A small number of predetermined printing command is beforehand registered into the command analysis circuit 23, and the command analysis circuit 23 judges whether the received data are the registration command. As a registration command, there is a printing command (henceforth a "raster image command") which sends the CMYK raster image data which rasterizing, color conversion, half toning, and interlace processing finished, and there is [1st / 2nd] a command of fractions, such as FF (form feed) and a vertical format unit. When a receiving command is a registration command, the command analysis circuit 13 transmits a raster image command to the printing image expansion circuit 15, and transmits the command of FF or a vertical format unit to CPU11. Moreover, when received data do not correspond to a registration command (that is, he cannot understand received data), the command analysis circuit 13 stops analyzing the received data which follow that data and this, and transmits all of those data to CPU (this condition is called "giving-up mode").

[0017] Exclusive hardware circuitry 9 has the memory of further the for the printing image expansion circuit 25 and for image buffer 29, and the printing image expansion circuit 31. The

printing image expansion circuit 25 interprets the raster image command received from the command analysis circuit 23, and rearranges a CMYK raster image to the CMYK raster image (henceforth a "printing image") of a format which thawed ejection and this from compression and was suitable for actuation of a print station 19 from the format within a command in it, and secures the image buffer 29 on memory, and develops a printing image to the image buffer 29. The printing image transfer circuit 31 transmits the printing image in the image buffer 29 to a print station 19 according to the timing of a print station 31 of operation.

[0018] In addition, with this operation gestalt, the image-data processings in the printing image expansion circuit 25 are easy things, such as compressive thawing and recombination of a format, as mentioned above, and this is a desirable thing from a viewpoint which is going to develop exclusive hardware circuitry 9 cheaply. However, it is also possible to constitute so that the color conversion which the printer driver 5 is performing, half toning, and a part or all of interlace processing can be performed in the printing image expansion circuit 25. Since the burden of a printer driver 5 is mitigated when constituted such, it leads to much more improvement in the speed.

[0019] Exclusive hardware circuitry 9 has the CPU image expansion circuit 27 for developing further the printing image which CPU11 generated to the image buffer 29. The printer driver 5 by the side of a host is the old version which does not support this printer 3, and the cases where the CPU image expansion circuit 27 works are a case as the image data has been sent using the printing command of the old version which is not registered into exclusive hardware circuitry, and a case as this printer 3 is connected with the network and image datas, such as Network OS to a banner, were received from the printer driver on that network. In such a case, since he cannot understand the received data, and it becomes giving-up mode and all received data are transmitted to CPU11, CPU11 will interpret the command of received data and, as for the command analysis circuit 23, will generate a printing image. The image buffer 27 develops and the printing image which CPU11 generated is transmitted to a print station 31 by the CPU image expansion circuit 27 like the above.

[0020] Although the microcomputer 17 which consists of CPU11, ROM13, RAM15, etc. is programmed to be able to perform all command processing as mentioned above, it usually processes the command about a command, FF, a vertical format unit, etc. about printing conditions etc. Moreover, as mentioned above, processing of the image data sent by the printing command of the old version which cannot understand exclusive hardware circuitry 9, and the image data sent from Network OS is also performed exceptionally.

[0021] Furthermore, this microcomputer 17 also performs processing in which this command analysis circuit 23 is woken from giving-up mode (that is, it returns to the condition ("normal mode" as used in the field of this invention) that command analysis can be performed), by answering the predetermined restart command of a host computer 1, and giving a restart signal to the command analysis circuit 23 of exclusive hardware circuitry 9. Typically, this restart is used in the following scenes. That is, as mentioned above, the command group which specifies printing conditions etc. comes previously for every page, and a raster image command group follows a series of printing commands of a printer driver 5 at it. Since the command analysis circuit 25 of exclusive hardware circuitry 9 is giving-up mode while the command group which specifies printing conditions etc. is coming, after it finishes, you restart it and it can make it enable it to process a consecutive raster image command.

[0022] Actuation of the printer 3 under the above configuration is further explained with reference to drawing 2 and drawing 3 . Drawing 2 is the state transition diagram of the command analysis circuit 23 of exclusive hardware circuitry 9, and drawing 3 is the state transition diagram of CPU11.

[0023] If put into the power source of a printer 3, a reset signal will go into exclusive hardware circuitry 9 and CPU11, and both both will be in idle states (condition of waiting for the command) 41 and 51. Then, although a host's printer driver 5 sends a series of printing commands, this is the sequence that the command group which specifies printing conditions etc. comes previously for every page, a raster image command group, the command group of a vertical format unit, etc. come after that, and the command of FF comes to the last of each page, as above-mentioned. After the command group as which a printer driver 5 specifies the first printing conditions etc. in

that case finishes, before sending a consecutive raster image command group etc., the restart command mentioned above is sent. The NULL data of the amount (for example, dozens of bytes) which can cover enough the time amount which a restart (waking) of the command analysis circuit 25 takes are added to this restart command.

[0024] If such a series of printing commands come, although the command analysis circuit 25 of exclusive hardware circuitry 9 analyzes received data, it will shift to the condition 47 which shows the command which specifies printing conditions etc. first in drawing 2 at the carrier beam event since he cannot understand the command (it is not a registration command), will once return to the head of the command, and will transmit the command to CPU11. After this, the command analysis circuit 25 will be in a condition 49, stops command analysis, and transmits all consecutive receiving commands to CPU as they are. These conditions 47 and 49 are in giving-up mode 50 (in addition, conditions other than giving-up mode 50 are the "normal modes" as used in the field of this invention).

[0025] If the command group which specifies printing conditions etc. from the command analysis circuit 25 is transmitted at the time of starting when it is an idle state 51 as shown in drawing 3 , CPU11 will be in a condition 53 and will process the command. Whenever each carries out command-processing termination, CPU11 repeats actuation called ****** in response to return and again another command to an idle state 51. Since a restart command is received as mentioned above after the command group about printing conditions etc. finishes, CPU11 shifts to a condition 59, and outputs a restart signal to the command analysis circuit 23, and returns to an idle state 51 again.

[0026] As shown in drawing 2 , the command analysis circuit 23 in the giving-up mode 50 returns to an idle state 41 in response to a restart signal from CPU11 (it wakes up). Between time delays until it will be from a restart signal in an idle state 41, although the NULL data attached to a restart command are transmitted to CPU11, if NULL data are received as shown in drawing 3 , CPU11 will be in a condition 55, will read NULL data and will be thrown away. If the command analysis circuit 23 will be in an idle state 41, in response to the remaining NULL data, the command analysis circuit 23 will be in a condition 45, will read NULL data and will be thrown away. After NULL data finish, since the command control section 23 receives registration commands, such as a raster image command, FF, and a command about a vertical format unit, it will be in a condition 43 and will process each receiving command. In this case, a raster image command is transmitted to the printing image expansion circuit 25, and delivery, a vertical format unit, the command of FF, etc. are transmitted to CPU11. The printing image expansion circuit 25 interprets a raster image command, and develops a printing image. If the command of a vertical format unit or FF is received, CPU11 will be in a condition 53 and will process each command.

[0027] As mentioned above, high-speed printing is realized by carrying out by exclusive hardware circuitry 9 and CPU11 sharing processing suitable for each.

[0028] As mentioned above, although 1 operation gestalt of this invention was explained, these operation gestalten are the instantiation for explanation of this invention to the last, and are not the meaning which limits this invention only to these operation gestalt. Therefore, this invention can be carried out also with various gestalten other than the above-mentioned operation gestalt.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention relates to the printer suitable for high-speed printing.

[Translation done.]

PRIOR ART

[Description of the Prior Art] The printer generally used by the computer system interprets to reception a series of printing commands described with the predetermined printer control language from the host computer, interprets those printing commands in order, and performs printing actuation based on the interpretation result. The conventional printer contains the microcomputer which consists of CPU, a ROM, RAM, etc., and chiefly, a printing command is received from a host, this is interpreted, and this microcomputer is based on that interpretation result, and is driving and controlling devices, such as the print head.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Inevitably, the processing speed of the microcomputer in a printer is an important factor which influences the print speed of a printer. Therefore, although the conventional high speed printer carries CPU of a high speed and high performance, the price is as high as cone **** as a result.
[0004] Therefore, the object of this invention is a low price, and is to offer the printer in which high-speed printing is possible.

[Translation done.]

MEANS

[Means for Solving the Problem] This invention offers the technique which freed itself from the conventional method of performing all command processing by CPU, radically. Generally, various printing commands, such as a command which specifies the various parameters about printing conditions etc., and a command which sends the image data which is an object for printing, are contained in a series of printing commands which a printer receives. Since the greater part of this printing command of a series of is occupied by the image data, the great portion of processing which a printer performs is processing of an image data. Typically, processing of this image data thaws the image data which is usually compressed in the form of predetermined, and is included in the printing command from the ejection from a command, and compression, and changes it into the specific format of having been suitable for actuation of print stations, such as the print head, (the so-called "expansion of a printing image"), and data manipulation of transmitting that printing image to a print station is performed according to the timing of a print station of operation. Although this image-data processing is made to perform to CPU chiefly with the conventional technique, this is only the huge repeat of the rather simple data manipulation instead of processing exceptionally complicated for CPU. However, CPU is equipment which originally fitted complicated processing and general-purpose usage, and cannot demonstrate rapidity sufficient in an activity which repeats simple data manipulation and performs it. In such an activity, many of work of CPU is beginning to put data into memory and making them it, and since data receipts and payments of the count of huge are serially repeated on the target through one CPU bus, so high-speed processing can be desired neither from the rate of a CPU bus, nor constraint of occupancy time amount. On the other hand, although there are few throughputs of each command about a command which notifies various kinds of parameters about printing conditions etc. also in a printing command, since the contents of processing differ for every command and various commands exist, it is suitable for processing by CPU.
[0006] Based on such reflection, by this invention, the exclusive hardware circuitry which performs image-data processing is carried in a printer, and CPU is released from the repeat activity of simple data manipulation. Since image-data processing is performed by exclusive hardware circuitry, naturally as compared with the conventional technique in which it was performed by CPU, high-speed printing becomes possible. However, there is also an advantage that the advantage of this invention not only of it but a price hike according to this amelioration further is small. That is, since the content of processing of image-data processing is simple in comparison, the exclusive hardware circuitry does not need to be so complicated structure, and, therefore, it can be managed with a low price. Moreover, since Printer CPU was released from image-data processing, it does not need to be so high-speed and is easy to be the thing of a low price. Therefore, the high-speed printing engine performance can be attained, without raising a price like the conventional technique which introduces a high speed CPU.
[0007] Although exclusive hardware circuitry is not unable to be made to perform all command processing, with a suitable operation gestalt, exclusive hardware circuitry only understands and processes the printing command which sends an image data, and the printing command of other fractions, and CPU processes other various printing commands. If it does so, hardware circuitry does not become complicated too much in vain, moreover, self can perform command processing of a favorite class and CPU can attain most effectively the object of the improvement in the

speed mentioned above and low-pricing.
[0008] Moreover, with a suitable operation gestalt, exclusive hardware circuitry communicates with a host computer, data are received, it judges whether it is the predetermined command with which the data can process self, and the data which cannot be processed are sent to CPU. Therefore, CPU stops involving also about a communication interface with a host computer, and it leads to much more improvement in the speed.
[0009] Moreover, with a suitable operation gestalt, exclusive hardware circuitry has original memory different from RAM of CPU, and sends a printing image to a print station, without developing a printing image in this memory and minding CPU. This configuration is also one device which releases CPU from image processing. Moreover, although CPU may generate a printing image exceptionally so that it may mention later, exclusive hardware circuitry receives the printing image which CPU generated also in such a case, and it develops in self memory, and sends to a print station. This also mitigates the burden of CPU and leads to much more improvement in the speed.
[0010] For every page, the command group which specifies printing conditions etc. comes previously, and the command which sends an image data usually follows sequence in case a printing command comes from a host at it. Although this sequence is adopted also with the suitable operation gestalt of this invention, delivery (such a condition of exclusive hardware circuitry is called "giving-up mode") and CPU understand these commands to CPU, and he is trying for exclusive hardware circuitry to process to it the command group which specifies the printing conditions which come previously, without understanding this. And the command group which specifies printing conditions etc. finishes, and when it is going to begin to send the command which sends an image data next, he is trying for the printer driver by the side of a host to send the meaningless data (NULL data) of a considerable amount (for example, dozens of bytes) for the special command ("restart command") which orders CPU to wake exclusive hardware circuitry from giving-up mode after delivery and this restart command in advance of it. Meaningless data are only sent until it wakes up thoroughly by this command configuration, although exclusive hardware circuitry wakes up from giving-up mode with a restart command just before receiving the command of an image data, and after waking up thoroughly, the command of an image data will be received for the first time. As a result, exclusive hardware circuitry can start image-data processing certainly.
[0011] Furthermore, with the suitable operation gestalt, the firmware of CPU understands all the commands that may come from a host, and it is perfectly prepared so that all processings also including image-data processing can be performed by CPU. Thereby, the printer driver for example, by the side of a host is an old version, and even if it has sent the image by the printing command of the old version which cannot understand exclusive hardware circuitry, a printer can understand those printing commands by CPU, can develop a printing image, and can be printed normally. Moreover, it is possible for the printer to be connected with the network, and for a printer to process the image for a carrier beam case etc. by CPU from the Network OS of the Network Server instead of a printer driver, and to, print an image data (for example, image of a banner) for example.
[0012]
[Embodiment of the Invention] Drawing 1 shows the configuration of 1 operation gestalt of this invention.
[0013] The printer 3 is connected to the host computer 1 through the local interface or the network. The printer driver 5 for printer 3 is carried in the host computer 1, and this printer driver 5 generates a series of printing commands described with the predetermined printer control language which can understand a printer 3, and sends that printing command of a series of to a printer 3 through OS. If the breakdown of this printing command of a series of is said simply, the printing command group which the printing command group which specifies printing conditions etc. for every page is sent previously, and sends an image data will follow it.
[0014] in addition , the image data include in the printing command presuppose that it be compress by the fixed technique of be a data gestalt (CMYK raster image data which be the 2 gradation as the expression capacity of a printer 3 with the same number of gradation or the several floor tone of each color component value of each pixel typically) in which rasterize , color conversion , half

toning , interlace processing , etc. be already finished by the printer driver 5 side with this operation gestalt . However, as long as that is not necessarily right, it may not necessarily be and you may be other image-data gestalten (for example, for example, color conversion, half toning, full color RGB raster data before interlace processing, etc.). Although complicated extent of the image-data processing which should be performed by the printer 3 side by what kind of gestalt the image data in a printing command is differs, since there is no need of performing color conversion, half toning, and interlace processing in a printer 3 side in the case of this operation gestalt, the image-data processing will become the easiest.

[0015] The exclusive hardware circuitry 9 for performing image-data processing is carried in the printer 3. This exclusive hardware circuitry is ASIC (ApplicationSpecific IC), and is the last computer which would perform software by CPU. On the other hand, the microcomputer 17 which consists of CPU11, ROM13, RAM15, etc. is also carried, and exclusive hardware circuitry 9 is connected to the bus of CPU11. This microcomputer 17 is programmed to be able to process the printing command of all the classes that a printer 3 may receive as firmware in ROM13, although it is for mainly performing processings (for example, printing command processing about printing conditions etc.) which exclusive hardware circuitry 9 does not perform in processing with the need that a printer 3 performs. Moreover, the print stations 19, such as the print head for printing a printing image on a form actually using a coloring agent, are also connected to exclusive hardware circuitry 9.

[0016] Exclusive hardware circuitry 9 performs communication-interface processing with a host computer, and has the host interface circuit 21 which receives the data from a printer driver 5, and the command analysis circuit 13 which analyzes the received data and changes the destination. A small number of predetermined printing command is beforehand registered into the command analysis circuit 23, and the command analysis circuit 23 judges whether the received data are the registration command. As a registration command, there is a printing command (henceforth a "raster image command") which sends the CMYK raster image data which rasterizing, color conversion, half toning, and interlace processing finished, and there is [1st / 2nd] a command of fractions, such as FF (form feed) and a vertical format unit. When a receiving command is a registration command, the command analysis circuit 13 transmits a raster image command to the printing image expansion circuit 15, and transmits the command of FF or a vertical format unit to CPU11. Moreover, when received data do not correspond to a registration command (that is, he cannot understand received data), the command analysis circuit 13 stops analyzing the received data which follow that data and this, and transmits all of those data to CPU (this condition is called "giving-up mode").

[0017] Exclusive hardware circuitry 9 has the memory of further the for the printing image expansion circuit 25 and for image buffer 29, and the printing image expansion circuit 31. The printing image expansion circuit 25 interprets the raster image command received from the command analysis circuit 23, and rearranges a CMYK raster image to the CMYK raster image (henceforth a "printing image") of a format which thawed ejection and this from compression and was suitable for actuation of a print station 19 from the format within a command in it, and secures the image buffer 29 on memory, and develops a printing image to the image buffer 29. The printing image transfer circuit 31 transmits the printing image in the image buffer 29 to a print station 19 according to the timing of a print station 31 of operation.

[0018] In addition, with this operation gestalt, the image-data processings in the printing image expansion circuit 25 are easy things, such as compressive thawing and recombination of a format, as mentioned above, and this is a desirable thing from a viewpoint which is going to develop exclusive hardware circuitry 9 cheaply. However, it is also possible to constitute so that the color conversion which the printer driver 5 is performing, half toning, and a part or all of interlace processing can be performed in the printing image expansion circuit 25. Since the burden of a printer driver 5 is mitigated when constituted such, it leads to much more improvement in the speed.

[0019] Exclusive hardware circuitry 9 has the CPU image expansion circuit 27 for developing further the printing image which CPU11 generated to the image buffer 29. The printer driver 5 by the side of a host is the old version which does not support this printer 3, and the cases where the CPU image expansion circuit 27 works are a case as the image data has been sent using the

printing command of the old version which is not registered into exclusive hardware circuitry, and a case as this printer 3 is connected with the network and image datas, such as Network OS to a banner, were received from the printer driver on that network. In such a case, since he cannot understand the received data, and it becomes giving-up mode and all received data are transmitted to CPU11, CPU11 will interpret the command of received data and, as for the command analysis circuit 23, will generate a printing image. The image buffer 27 develops and the printing image which CPU11 generated is transmitted to a print station 31 by the CPU image expansion circuit 27 like the above.

[0020] Although the microcomputer 17 which consists of CPU11, ROM13, RAM15, etc. is programmed to be able to perform all command processing as mentioned above, it usually processes the command about a command, FF, a vertical format unit, etc. about printing conditions etc. Moreover, as mentioned above, processing of the image data sent by the printing command of the old version which cannot understand exclusive hardware circuitry 9, and the image data sent from Network OS is also performed exceptionally.

[0021] Furthermore, this microcomputer 17 also performs processing in which this command analysis circuit 23 is woken from giving-up mode (that is, it returns to the condition ("normal mode" as used in the field of this invention) that command analysis can be performed), by answering the predetermined restart command of a host computer 1, and giving a restart signal to the command analysis circuit 23 of exclusive hardware circuitry 9. Typically, this restart is used in the following scenes. That is, as mentioned above, the command group which specifies printing conditions etc. comes previously for every page, and a raster image command group follows a series of printing commands of a printer driver 5 at it. Since the command analysis circuit 25 of exclusive hardware circuitry 9 is giving-up mode while the command group which specifies printing conditions etc. is coming, after it finishes, you restart it and it can make it enable it to process a consecutive raster image command.

[0022] Actuation of the printer 3 under the above configuration is further explained with reference to drawing 2 and drawing 3 . Drawing 2 is the state transition diagram of the command analysis circuit 23 of exclusive hardware circuitry 9, and drawing 3 is the state transition diagram of CPU11.

[0023] If put into the power source of a printer 3, a reset signal will go into exclusive hardware circuitry 9 and CPU11, and both both will be in idle states (condition of waiting for the command) 41 and 51. Then, although a host's printer driver 5 sends a series of printing commands, this is the sequence that the command group which specifies printing conditions etc. comes previously for every page, a raster image command group, the command group of a vertical format unit, etc. come after that, and the command of FF comes to the last of each page, as above-mentioned. After the command group as which a printer driver 5 specifies the first printing conditions etc. in that case finishes, before sending a consecutive raster image command group etc., the restart command mentioned above is sent. The NULL data of the amount (for example, dozens of bytes) which can cover enough the time amount which a restart (waking) of the command analysis circuit 25 takes are added to this restart command.

[0024] If such a series of printing commands come, although the command analysis circuit 25 of exclusive hardware circuitry 9 analyzes received data, it will shift to the condition 47 which shows the command which specifies printing conditions etc. first in drawing 2 at the carrier beam event since he cannot understand the command (it is not a registration command), will once return to the head of the command, and will transmit the command to CPU11. After this, the command analysis circuit 25 will be in a condition 49, stops command analysis, and transmits all consecutive receiving commands to CPU as they are. These conditions 47 and 49 are in giving-up mode 50 (in addition, conditions other than giving-up mode 50 are the "normal modes" as used in the field of this invention).

[0025] If the command group which specifies printing conditions etc. from the command analysis circuit 25 is transmitted at the time of starting when it is an idle state 51 as shown in drawing 3 , CPU11 will be in a condition 53 and will process the command. Whenever each carries out command-processing termination, CPU11 repeats actuation called ****** in response to return and again another command to an idle state 51. Since a restart command is received as mentioned above after the command group about printing conditions etc. finishes, CPU11 shifts to a condition

59, and outputs a restart signal to the command analysis circuit 23, and returns to an idle state 51 again.

[0026] As shown in drawing 2 , the command analysis circuit 23 in the giving-up mode 50 returns to an idle state 41 in response to a restart signal from CPU11 (it wakes up). Between time delays until it will be from a restart signal in an idle state 41, although the NULL data attached to a restart command are transmitted to CPU11, if NULL data are received as shown in drawing 3 , CPU11 will be in a condition 55, will read NULL data and will be thrown away. If the command analysis circuit 23 will be in an idle state 41, in response to the remaining NULL data, the command analysis circuit 23 will be in a condition 45, will read NULL data and will be thrown away. After NULL data finish, since the command control section 23 receives registration commands, such as a raster image command, FF, and a command about a vertical format unit, it will be in a condition 43 and will process each receiving command. In this case, a raster image command is transmitted to the printing image expansion circuit 25, and delivery, a vertical format unit, the command of FF, etc. are transmitted to CPU11. The printing image expansion circuit 25 interprets a raster image command, and develops a printing image. If the command of a vertical format unit or FF is received, CPU11 will be in a condition 53 and will process each command.

[0027] As mentioned above, high-speed printing is realized by carrying out by exclusive hardware circuitry 9 and CPU11 sharing processing suitable for each.

[0028] As mentioned above, although 1 operation gestalt of this invention was explained, these operation gestalten are the instantiation for explanation of this invention to the last, and are not the meaning which limits this invention only to these operation gestalt. Therefore, this invention can be carried out also with various gestalten other than the above-mentioned operation gestalt.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing the configuration of 1 operation gestalt of this invention.
[Drawing 2] The state transition diagram of the command analysis circuit 23 of exclusive hardware circuitry 9.
[Drawing 3] The state transition diagram of CPU11.
[Description of Notations]
1 Host Computer
3 Printer
5 Printer Driver
9 Exclusive Hardware Circuitry
11 CPU
17 Microcomputer
19 Print Station
21 Host Interface Circuit
23 Command Analysis Circuit
25 Printing Image Expansion Circuit
27 CPU Image Expansion Circuit
29 Image Buffer
31 Printing Image Transfer Circuit

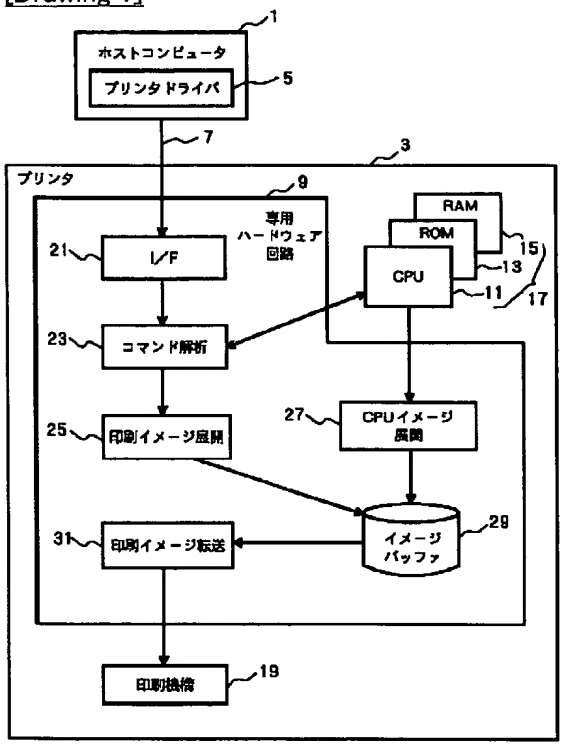
[Translation done.]

* NOTICES *

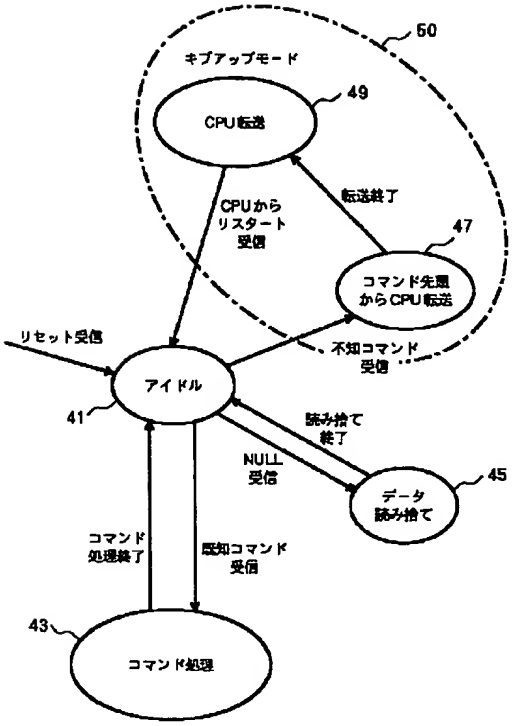
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

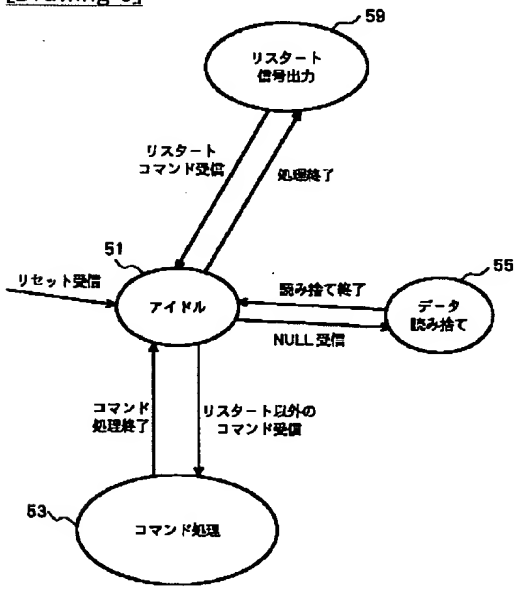
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]

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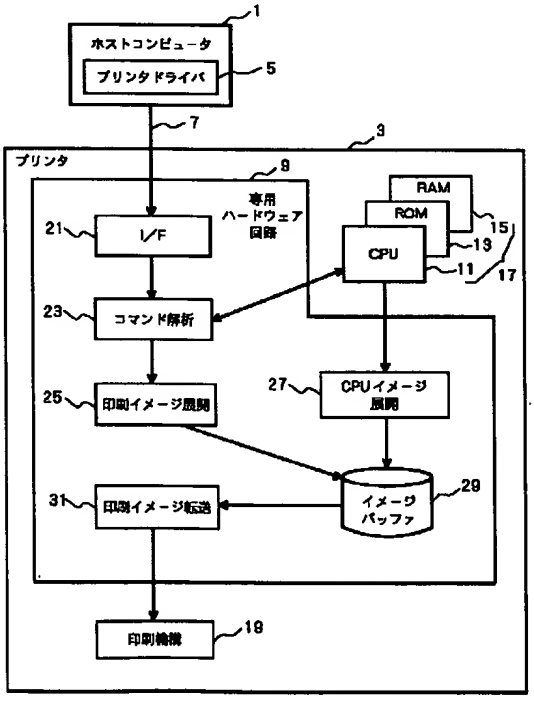
(54)【発明の名称】　プリンタ及びプリントシステム

(57)【要約】

【課題】　安価なプリンタで高速印刷を実現する。

【解決手段】　プリンタ３は専用ハードウェア回路９を有し、この専用ハードウェア回路９は、ホスト１からの印刷コマンドを受信し、受信したコマンドがイメージデータを送ってきたコマンドである場合は、そのイメージデータを処理して印刷イメージを展開し、そのイメージデータを印刷ヘッドなどの印刷機構１９へ送る。また、専用ハードウェア回路９は、受信したコマンドが、印刷条件や紙送りなどに関するコマンドである場合は、これをＣＰＵ１１へ送ってＣＰＵ１１に処理してもらう。ＣＰＵ１１は原則としてイメージデータの処理は行わない。



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【特許請求の範囲】

【請求項１】　一連の印刷コマンドを受信し前記印刷コマンドに基づいて印刷機構を駆動するプリンタにおいて、

前記印刷コマンドに組み込まれたイメージデータを処理して、前記印刷機構へ送るべき印刷イメージを生成する専用ハードウェア回路を備えたプリンタ。

【請求項２】　さらにマイクロコンピュータを備え、

前記専用ハードウェア回路は、前記一連の印刷コマンドに含まれる多種類の印刷コマンドのうち、前記イメージデータを送ってくる印刷コマンドを含む所定の一部の印刷コマンドのみを処理し、

前記マイクロコンピュータは、前記多種類の印刷コマンドのうち、少なくとも、前記所定の一部の印刷コマンドを除く他の印刷コマンドを処理する請求項１記載のプリンタ。

【請求項３】　前記専用ハードウェア回路が、

前記一連の印刷コマンドを受信するインタフェース回路と、

前記イメージデータを送ってくる印刷コマンドを処理して前記印刷イメージを生成する印刷イメージ展開回路と、

前記インタフェース回路で受信した印刷コマンドを解析して、前記イメージデータを送ってくる印刷コマンドは前記印刷イメージ展開回路へ転送し、前記他の印刷コマンドは前記マイクロコンピュータへ転送するコマンド解析回路とを有する請求項２記載のプリンタ。

【請求項４】　前記専用ハードウェア回路が、

前記印刷イメージを展開するためのメモリであって、前記マイクロコンピュータのメモリとは別の独自のメモリと、

前記独自のメモリに展開された前記印刷イメージを前記印刷機構へ転送する印刷イメージ転送回路とを有する請求項２記載のプリンタ。

【請求項５】　前記専用ハードウェア回路が、前記マイクロコンピュータが生成した印刷イメージを受けて前記独自のメモリへ展開するためのをＣＰＵイメージ展開回路を更に有する請求項４記載のプリンタ。

【請求項６】　前記専用ハードウェア回路は、前記一連の印刷コマンドを受信し、通常モードでは、受信した印刷コマンドが前記所定の一部の印刷コマンドであるとき、前記受信した印刷コマンドを理解して処理し、前記受信した印刷コマンドが理解できないものであるとき、以後ギブアップモードに移行して前記受信したコマンド及び後続のコマンドを全て理解せずに前記マイクロコンピュータへ転送し、

前記マイクロコンピュータは、前記専用ハードウェア回路から受け取ったコマンドを理解して処理し、かつ、前記受け取ったコマンドが所定のリスタートコマンドであるとき、前記専用ハードウェア回路に対しリスタート信号を与えて前記ギブアップモードから前記通常モードへ復帰させる請求項２記載のプリンタ。

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【請求項７】　前記リスタートコマンドには、前記専用ハードウェア回路が前記ギブアップモードから前記通常モードへ復帰するのに要する時間をカバーできる量の無意味データが付加されており、

前記マイクロコンピュータ、及び前記通常モードにある前記専用ハードウェア回路は、前記無意味データを読み捨てる請求項６記載のプリンタ。

【請求項８】　前記マイクロコンピュータが、前記一連の印刷コマンドに含まれる可能性のある実質的に全ての印刷コマンドを処理することができる請求項２記載のプリンタ。

【請求項９】　プリンタドライバを有したホストコンピュータと、前記プリンタドライバが生成した一連の印刷コマンドを受信して前記印刷コマンドに基づいて印刷機構を駆動するプリンタとを備えたプリントシステムにおいて、

前記プリンタが、前記印刷コマンドに組み込まれたイメージデータを処理して前記印刷機構へ送るべき印刷イメージを生成する専用ハードウェア回路を備えたプリントシステム。

【請求項１０】　前記プリンタがさらにマイクロコンピュータを備え、

前記専用ハードウェア回路は、前記一連の印刷コマンドに含まれる多種類の印刷コマンドのうち、前記イメージデータを送ってくる印刷コマンドを含む所定の一部の印刷コマンドのみを処理し、

前記マイクロコンピュータは、前記多種類の印刷コマンドのうち、少なくとも、前記所定の一部の印刷コマンドを除く他の印刷コマンドを処理する請求項９記載のプリントシステム。

【請求項１１】　前記プリンタドライバは、前記一連の印刷コマンドを送るとき、前記他の印刷コマンドから前記所定の一部の印刷コマンドへ切替える際に所定のリスタートコマンドを送り、

前記プリンタの専用ハードウェア回路は、前記一連の印刷コマンドを受信し、通常モードでは、受信した印刷コマンドが前記所定の一部の印刷コマンドであるとき、前記受信した印刷コマンドを理解して処理し、前記受信した印刷コマンドが理解できないものであるとき、以後ギブアップモードに移行して前記受信したコマンド及び後続のコマンドを全て理解せずに前記マイクロコンピュータへ転送し、

前記マイクロコンピュータは、前記専用ハードウェア回路から受け取ったコマンドを理解して処理し、かつ、前記受け取ったコマンドが前記リスタートコマンドであるとき、前記専用ハードウェア回路に対しリスタート信号を与えて前記ギブアップモードから前記通常モードへ復帰させる請求請１０記載のプリントシステム。

【請求項１２】　前記プリンタドライバは、前記リスタートコマンドに、前記専用ハードウェア回路が前記ギブアップモードから前記通常モードへ復帰するのに要する時間をカバーできる量の無意味データを付加し、
前記マイクロコンピュータ、及び前記通常モードにある前記専用ハードウェア回路は、前記無意味データを読み捨てる請求項１１記載のプリントシステム。
【請求項１３】　一連の印刷コマンドを受信して前記一連の印刷コマンドに含まれる多種類の印刷コマンドのうち所定の一部の印刷コマンドのみを処理する専用ハードウェア回路と、前記一連の印刷コマンドに含まれる多種類の印刷コマンドのうち前記所定の一部の印刷コマンドを除く他の印刷コマンドを処理するマイクロコンピュータとを備えたプリンタに対して、前記一連の印刷コマンドを送るホストコンピュータであって、
前記一連の印刷コマンドを送るとき、前記他の印刷コマンドから前記所定の一部の印刷コマンドへ切替える際、前記マイクロコンピュータに対し前記専用ハードウェア回路をリスタートさせることを前記マイクロコンピュータに命じるためのリセットコマンドを送るホストコンピュータ。
【請求項１４】　前記リスタートコマンドに、前記専用ハードウェア回路及び前記マイクロコンピュータが読み捨てる無意味データを所定量付加する請求項１３記載のホストコンピュータ。
【請求項１５】　一連の印刷コマンドを受信して前記一連の印刷コマンドに含まれる多種類の印刷コマンドのうち所定の一部の印刷コマンドのみを処理する専用ハードウェア回路と、前記一連の印刷コマンドに含まれる多種類の印刷コマンドのうち前記所定の一部の印刷コマンドを除く他の印刷コマンドを処理するマイクロコンピュータとを備えたプリンタに対して、前記一連の印刷コマンドを送るホストコンピュータであって、
前記一連の印刷コマンドを送るとき、前記他の印刷コマンドから前記所定の一部の印刷コマンドへ切替える際、前記マイクロコンピュータに対し前記専用ハードウェア回路をリスタートさせることを前記マイクロコンピュータに命じるためのリセットコマンドを送るホストコンピュータとして、コンピュータを機能させるためのプリンタドライバプログラムを担持したコンピュータ読み取り可能な記録媒体。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、高速印刷に適したプリンタに関する。
【０００２】
【従来の技術】コンピュータシステムで一般に用いられているプリンタは、ホストコンピュータから所定のプリンタ制御言語で記述された一連の印刷コマンドを受け取り、それらの印刷コマンドを順に解釈し、その解釈結果

に基づいて印刷動作を行う。従来のプリンタは、ＣＰＵ、ＲＯＭ、ＲＡＭなどからなるマイクロコンピュータを内蔵し、専らこのマイクロコンピュータが、ホストから印刷コマンドを受信し、これを解釈し、その解釈結果に基づいて印刷ヘッド等の機構を駆動及び制御している。
【０００３】
【発明が解決しようとする課題】必然的に、プリンタ内のマイクロコンピュータの処理速度はプリンタの印刷速度を左右する重要な要因である。従って、従来の高速プリンタは、高速・高性能のＣＰＵを搭載しているが、結果として、その価格はすいぶんと高い。
【０００４】従って、本発明の目的は、低価格でかつ高速印刷が可能なプリンタを提供することにある。
【０００５】
【課題を解決するための手段】本発明は、ＣＰＵで全コマンド処理を行おうとする従来のやり方から抜本的に脱却した技術を提供するものである。一般に、プリンタが受ける一連の印刷コマンドには、印刷条件等に関する各種パラメータを指定するコマンドや、印刷対象であるイメージデータを送って来るコマンドなど、多種多様の印刷コマンドが含まれている。この一連の印刷コマンドの大部分はイメージデータで占められているから、プリンタが行う処理の大部分もイメージデータの処理である。このイメージデータの処理とは、典型的には、所定の形式で通常は圧縮されて印刷コマンドに組み込まれているイメージデータを、コマンドから取り出し、圧縮から解凍し、印刷ヘッド等の印刷機構の駆動に適した特定の形式に変換し（いわゆる「印刷イメージの展開」）、そして、その印刷イメージを印刷機構に転送する、といったデータ操作を、印刷機構の動作タイミングに合わせて行っていくものである。従来技術では、このイメージデータ処理を専らＣＰＵに行わせているが、これはＣＰＵにとって格別複雑な処理ではなく、むしろ単純なデータ操作の膨大な繰り返しに過ぎない。しかし、ＣＰＵは本来、複雑な処理や汎用的な使い方に適した装置であって、単純なデータ操作を繰り返し行うような作業では十分な高速性を発揮することができない。このような作業では、ＣＰＵの仕事の多くはメモリにデータを入れ出しすることであり、１つのＣＰＵバスを通じて膨大回数のデータ出し入れを逐次的に繰り返していくわけであるから、ＣＰＵバスの速度や占有時間の制約からそれほど高速な処理は望めない。一方、印刷コマンドの中でも、印刷条件などに関する各種のパラメータを通知するようなコマンドについては、個々のコマンドの処理量は少ないが、コマンド毎に処理内容が異なり且つ多種多様のコマンドが存在するから、ＣＰＵで処理するのに適したものである。
【０００６】このような反省に基づき、本発明では、イメージデータ処理を行う専用ハードウェア回路をプリン

タに搭載し、ＣＰＵを単純データ操作の繰り返し作業から解放する。専用ハードウェア回路でイメージデータ処理を行うわけであるから、それをＣＰＵで行っていた従来技術に比較して高速印刷が可能になることは当然である。しかし、本発明の利点はそれだけではなく、さらに、この改良による価格上昇は小さいという利点もある。すなわち、イメージデータ処理の処理内容は比較的に単純であるから、その専用ハードウェア回路は、それほど複雑な構造である必要はなく、よって低価格で済む。また、プリンタＣＰＵも、イメージデータ処理から解放されたので、それほど高速である必要はなく低価格のものでよい。従って、高速ＣＰＵを導入する従来技術ほどに価格を上げることなく高速印刷性能を達成できる。

【０００７】全てのコマンド処理を専用ハードウェア回路が行うようにすることも不可能ではないが、好適な実施形態では、専用ハードウェア回路はイメージデータを送ってくる印刷コマンドと他の少数の印刷コマンドを理解して処理するだけであり、その他の多種多様な印刷コマンドはＣＰＵが処理する。そうするとハードウェア回路がいたずらに複雑になり過ぎることがなく、しかも、ＣＰＵは自己が得意な種類のコマンド処理を行うことができ、上述した高速化と低価格化の目的を最も効果的に達成できる。

【０００８】また、好適な実施形態では、専用ハードウェア回路がホストコンピュータと通信してデータを受信し、そのデータが自己の処理できる所定のコマンドであるか否か判断し、処理できないデータはＣＰＵへ送る。そのため、ホストコンピュータとの通信インタフェースについてもＣＰＵが関与しなくなり、いっそうの高速化につながる。

【０００９】また、好適な実施形態では、専用ハードウェア回路は、ＣＰＵのＲＡＭとは別の独自のメモリをもっており、このメモリに印刷イメージを展開してＣＰＵを介さずに印刷イメージを印刷機構へ送るようになっている。この構成もＣＰＵをイメージ処理から解放する一つの工夫である。また、後述するように例外的にＣＰＵが印刷イメージを生成する場合があるが、その場合にも、ＣＰＵが生成した印刷イメージを専用ハードウェア回路が受け取って自己のメモリに展開し、印刷機構へ送る。このこともＣＰＵの負担を軽減しいっそうの高速化につながる。

【００１０】ホストから印刷コマンドが来るときの順序は、通常、各ページ毎に、印刷条件などを指定するコマンド群が先に来て、イメージデータを送るコマンドがそれに後続する。本発明の好適な実施形態でもこの順序を採用しているが、先に来る印刷条件などを指定するコマンド群については、専用ハードウェア回路は、これを理解せずにＣＰＵへ送り（専用ハードウェア回路のこのような状態を「ギブアップモード」という）、ＣＰＵがこれらのコマンドを理解し処理するようにしている。そして、ホスト側のプリンタドライバは、印刷条件などを指定するコマンド群が終わって、次にイメージデータを送るコマンドを送り始めようとするとき、それに先立って、専用ハードウェア回路をギブアップモードから目覚めさせることをＣＰＵに命じる特別のコマンド（「リスタートコマンド」）を送り、このリスタートコマンドの後に相当量（例えば数十バイト）の無意味データ（ＮＵＬＬデータ）を送るようにしている。このコマンド構成により、専用ハードウェア回路は、イメージデータのコマンドを受ける直前にリスタートコマンドによってギブアップモードから目覚めるが、完全に目覚めるまでの間は無意味データが送られてくるだけであり、完全に目覚めた後に初めてイメージデータのコマンドを受けることになる。結果として、専用ハードウェア回路は確実にイメージデータ処理に入ることができる。

【００１１】さらに、好適な実施形態では、ＣＰＵのファームウェアは、ホストから到来する可能性のある全てのコマンドを理解し、イメージデータ処理も含め全ての処理をＣＰＵで行えるよう万全に用意されている。それにより、例えばホスト側のプリンタドライバが古いバージョンであって、専用ハードウェア回路が理解できない古いバージョンの印刷コマンドでイメージを送ってきたとしても、プリンタはそれらの印刷コマンドをＣＰＵで理解して印刷イメージを展開し、正常に印刷を行うことができる。また、例えば、プリンタがネットワークに繋がっていて、プリンタドライバではなくネットワークサーバのネットワークＯＳからイメージデータ（例えばバナーのイメージ）を受けた場合なども、プリンタはそのイメージをＣＰＵで処理して印刷することが可能である。

【００１２】

【発明の実施の形態】図１は、本発明の一実施形態の構成を示す。

【００１３】ホストコンピュータ１にローカルインタフェース又はネットワークなどを介してプリンタ３が接続されている。ホストコンピュータ１にはプリンタ３用のプリンタドライバ５が搭載されており、このプリンタドライバ５は、プリンタ３が理解できる所定のプリンタ制御言語で記述された一連の印刷コマンドを生成し、その一連の印刷コマンドをＯＳを通じてプリンタ３に送る。この一連の印刷コマンドの内訳は、簡単にいうと、各ページ毎に、印刷条件などを指定する印刷コマンド群が先に送られ、イメージデータを送る印刷コマンド群がそれに後続するというものである。

【００１４】なお、印刷コマンドに組み込まれているイメージデータは、この実施形態では、既にプリンタドライバ５側でラスタライズ、色変換、ハーフトーニング及びインタレース処理などを終えたデータ形態（典型的には、各画素の各色成分値の階調数がプリンタ３の表現能

力と同じ２階調または数階調であるＣＭＹＫラスタイメージデータ）であって且つ一定の手法で圧縮されたものであるとする。しかし、必ずしもそうでなければないわけではなく、他のイメージデータ形態（例えば、色変換やハーフトーニングやインタレース処理前の例えばフルカラーＲＧＢラスタデータなど）であってもよい。印刷コマンド内のイメージデータがどのような形態であるかによりプリンタ３側で行うべきイメージデータ処理の複雑程度が異なってくるが、本実施形態の場合は、プリンタ３側では色変換やハーフトーニングやインタレース処理を行う必要が無いので、そのイメージデータ処理は最も簡単なものになる。

【００１５】プリンタ３には、イメージデータ処理を行うための専用ハードウェア回路９が搭載されている。この専用ハードウェア回路は、例えばＡＳＩＣ（ApplicationSpecific IC）であって、ソフトウェアをＣＰＵで実行するようなコンピュータではない。一方、ＣＰＵ１１、ＲＯＭ１３、ＲＡＭ１５などからなるマイクロコンピュータ１７も搭載されており、ＣＰＵ１１のバスに専用ハードウェア回路９が接続されている。このマイクロコンピュータ１７は、プリンタ３で行う必要のある処理の中で専用ハードウェア回路９が行わない処理（例えば、印刷条件等に関する印刷コマンド処理など）を主として行うためのものであるが、ＲＯＭ１３内のファームウェアとしては、プリンタ３が受信する可能性のある全ての種類の印刷コマンドが処理できるようプログラムされている。また、印刷イメージを着色剤を用いて実際に用紙上に印刷するための印刷ヘッドなどの印刷機構１９も、専用ハードウェア回路９に接続されている。

【００１６】専用ハードウェア回路９は、ホストコンピュータとの通信インタフェース処理を行って、プリンタドライバ５からのデータを受信するホストインタフェース回路２１、および、受信したデータを解析してその転送先を切替えるコマンド解析回路１３を有している。コマンド解析回路２３には少数の所定の印刷コマンドが予め登録されていて、コマンド解析回路２３は受信したデータがその登録コマンドであるか否かを判断する。登録コマンドとしては、第１に、ラスタライズ、色変換、ハーフトーニング及びインタレース処理の終わったＣＭＹＫラスタイメージデータを送ってくる印刷コマンド（以下、「ラスタイメージコマンド」という）があり、第２に、ＦＦ（フォームフィード）や紙送り制御などの少数のコマンドがある。コマンド解析回路１３は、受信コマンドが登録コマンドである場合、そのうちラスタイメージコマンドは印刷イメージ展開回路１５へ転送し、ＦＦや紙送り制御のコマンドはＣＰＵ１１へ転送する。また、受信データが登録コマンドに該当しない（つまり、受信データが理解できない）場合には、コマンド解析回路１３は、そのデータ及びこれに後続する受信データの解析をやめて、それらのデータの一切をＣＰＵへ転送する（この状態を「ギブアップモード」という）。

【００１７】専用ハードウェア回路９は、さらに、印刷イメージ展開回路２５、イメージバッファ２９用のメモリ、及び印刷イメージ展開回路３１を有する。印刷イメージ展開回路２５は、コマンド解析回路２３から受け取ったラスタイメージコマンドを解釈して、ＣＭＹＫラスタイメージを取り出し、これを圧縮から解凍し、コマンド内での形式から印刷機構１９の駆動に適した形式のＣＭＹＫラスタイメージ（以下、「印刷イメージ」という）へ組み替え、そして、メモリ上にイメージバッファ２９を確保して、そのイメージバッファ２９に印刷イメージを展開する。印刷イメージ転送回路３１は、印刷機構３１の動作タイミングに合わせて、イメージバッファ２９内の印刷イメージを印刷機構１９へ転送する。

【００１８】なお、本実施形態では、印刷イメージ展開回路２５におけるイメージデータ処理は、上記のように圧縮の解凍や形式の組み替えといった簡単なものであり、このことは専用ハードウェア回路９を安価に開発しようとする観点から好ましいことである。しかし、プリンタドライバ５が行っている色変換やハーフトーニングやインタレース処理の一部又は全部を印刷イメージ展開回路２５で行えるように構成することも可能である。そのように構成した場合には、プリンタドライバ５の負担が軽減されるので、いっそうの高速化につながる。

【００１９】専用ハードウェア回路９は、さらに、ＣＰＵ１１が生成した印刷イメージをイメージバッファ２９に展開するためのＣＰＵイメージ展開回路２７を有する。ＣＰＵイメージ展開回路２７が働く場合とは、ホスト側のプリンタドライバ５がこのプリンタ３には対応していない古いバージョンであって、専用ハードウェア回路に登録されていない古いバージョンの印刷コマンドを用いてイメージデータを送ってきたような場合や、このプリンタ３がネットワークに繋がっていて、そのネットワーク上のプリンタドライバからでなくネットワークＯＳから例えばバナーなどのイメージデータを受信したような場合である。このような場合には、コマンド解析回路２３は受信したデータを理解できないためギブアップモードとなって受信データを全てＣＰＵ１１に転送するので、ＣＰＵ１１が受信データのコマンドを解釈して印刷イメージを生成することになる。ＣＰＵ１１が生成した印刷イメージは、ＣＰＵイメージ展開回路２７によってイメージバッファ２７に展開され、上記と同様に印刷機構３１へ転送される。

【００２０】ＣＰＵ１１、ＲＯＭ１３、ＲＡＭ１５などからなるマイクロコンピュータ１７は、前述したように、あらゆるコマンド処理ができるようにプログラムされているが、通常は、印刷条件等に関するコマンドや、ＦＦや紙送り制御などに関するコマンドの処理を行なう。また、上述したように、専用ハードウェア回路９が理解できない古いバージョンの印刷コマンドで送られて

きたイメージデータや、ネットワークＯＳから送られて来たイメージデータの処理も例外的に行う。

【００２１】さらに、このマイクロコンピュータ１７は、ホストコンピュータ１からの所定のリスタートコマンドに応答して、専用ハードウェア回路９のコマンド解析回路２３にリスタート信号を与えることにより、このコマンド解析回路２３をギブアップモードから目覚めさせる（つまり、コマンド解析が行える状態（本発明でいう「通常モード」）に戻す）という処理も行う。典型的には、このリスタートは次のような場面で使用される。すなわち、前述したように、プリンタドライバ５からの一連の印刷コマンドは、各ページ毎に、印刷条件などを指定するコマンド群が先に来て、ラスタイメージコマンド群がそれに後続する。専用ハードウェア回路９のコマンド解析回路２５は、印刷条件などを指定するコマンド群が来ている間はギブアップモードになっているので、それが終わった時点でリスタートさせて後続のラスタイメージコマンドを処理できるようにさせる。

【００２２】以上の構成の下でのプリンタ３の動作を、さらに図２および図３を参照して説明する。図２は、専用ハードウェア回路９のコマンド解析回路２３の状態遷移図であり、図３はＣＰＵ１１の状態遷移図である。

【００２３】プリンタ３の電源が入れられると、専用ハードウェア回路９及びＣＰＵ１１にリセット信号が入り、両者はともにアイドル状態（コマンドを待っている状態）４１、５１になる。その後、ホストのプリンタドライバ５が一連の印刷コマンドを送ってくるが、これは前述の通り、各ページ毎に、印刷条件などを指定するコマンド群が先に来て、その後にラスタイメージコマンド群や紙送り制御のコマンド群などが来て、各ページの最後にＦＦのコマンドが来るといった順序になっている。その際、プリンタドライバ５は、最初の印刷条件などを指定するコマンド群が終わると、後続のラスタイメージコマンド群などを送る前に、上述したリスタートコマンドを送るようになっている。このリスタートコマンドには、コマンド解析回路２５のリスタート（目覚め）に要する時間を十分カバーできる量（例えば数十バイト）のＮＵＬＬデータが付加されている。

【００２４】このような一連の印刷コマンドが来ると、専用ハードウェア回路９のコマンド解析回路２５は、受信データを解析するが、最初に印刷条件などを指定するコマンドを受けた時点で、そのコマンドが理解できない（登録コマンドでない）ため、図２に示す状態４７へ移行して、そのコマンドの先頭まで一旦もどってそのコマンドをＣＰＵ１１に転送する。これ以後、コマンド解析回路２５は、状態４９となってコマンド解析をやめ、後続の全ての受信コマンドをそのままＣＰＵへ転送する。この状態４７、４９がギブアップモード５０である（なお、ギブアップモード５０以外の状態が、本発明でいう「通常モード」である）。

【００２５】ＣＰＵ１１は、図３に示すように、起動時にアイドル状態５１であったところ、コマンド解析回路２５から印刷条件などを指定するコマンド群が転送されてくると、状態５３となってそのコマンドの処理を行う。個々のコマンド処理終了するたびＣＰＵ１１はアイドル状態５１に戻り、再び別のコマンドを受けて処理すという動作を繰り返す。印刷条件などに関するコマンド群が終わると、前述したようにリスタートコマンドを受けるので、ＣＰＵ１１は状態５９へ移行してリスタート信号をコマンド解析回路２３に出力し、そして再びアイドル状態５１に戻る。

【００２６】図２に示すように、ギブアップモード５０にあるコマンド解析回路２３は、ＣＰＵ１１からリスタート信号を受けて、アイドル状態４１へ復帰する（目覚める）。リスタート信号からアイドル状態４１になるまでの遅れ時間の間、リスタートコマンドに付属するＮＵＬＬデータがＣＰＵ１１へ転送されるが、ＣＰＵ１１は図３に示すようにＮＵＬＬデータを受けると状態５５になってＮＵＬＬデータを読み捨てる。コマンド解析回路２３がアイドル状態４１になると、残りのＮＵＬＬデータを受けてコマンド解析回路２３は状態４５になりＮＵＬＬデータを読み捨てる。ＮＵＬＬデータが終わると、コマンド制御部２３は、ラスタイメージコマンドや、ＦＦや紙送り制御に関するコマンドなどの登録コマンドを受けるので、状態４３になって各受信コマンドを処理する。この場合、ラスタイメージコマンドは印刷イメージ展開回路２５へ送り、紙送り制御やＦＦのコマンドなどはＣＰＵ１１へ転送する。印刷イメージ展開回路２５はラスタイメージコマンドを解釈して印刷イメージを展開する。ＣＰＵ１１は、紙送り制御やＦＦのコマンドを受けると状態５３になって各コマンドを処理する。

【００２７】以上のように、専用ハードウェア回路９とＣＰＵ１１とがそれぞれに適した処理を分担して行うことにより、高速印刷が実現される。

【００２８】以上、本発明の一実施形態を説明したが、これらの実施形態はあくまで本発明の説明のための例示であり、本発明をこれら実施形態にのみ限定する趣旨ではない。従って、本発明は、上記実施形態以外の様々な形態でも実施することができるものである。

【図面の簡単な説明】

【図１】本発明の一実施形態の構成を示すブロック図。

【図２】専用ハードウェア回路９のコマンド解析回路２３の状態遷移図。

【図３】ＣＰＵ１１の状態遷移図。

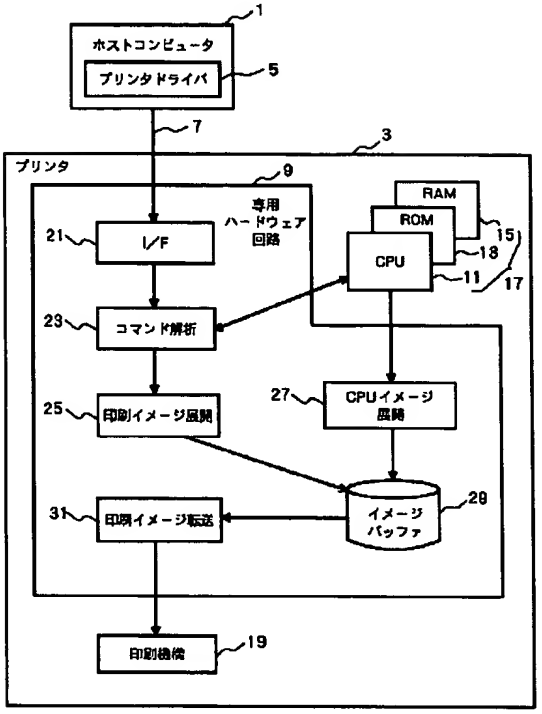
【符号の説明】

１　ホストコンピュータ
３　プリンタ
５　プリンタドライバ
９　専用ハードウェア回路
１１　ＣＰＵ

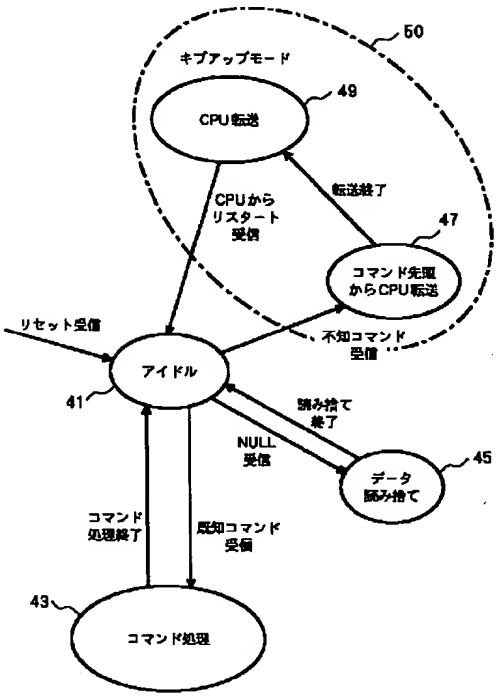
11　　12

１７　マイクロコンピュータ
１９　印刷機構
２１　ホストインタフェース回路
２３　コマンド解析回路
２５　印刷イメージ展開回路
２７　ＣＰＵイメージ展開回路
２９　イメージバッファ
３１　印刷イメージ転送回路

【図１】



【図２】



【図３】